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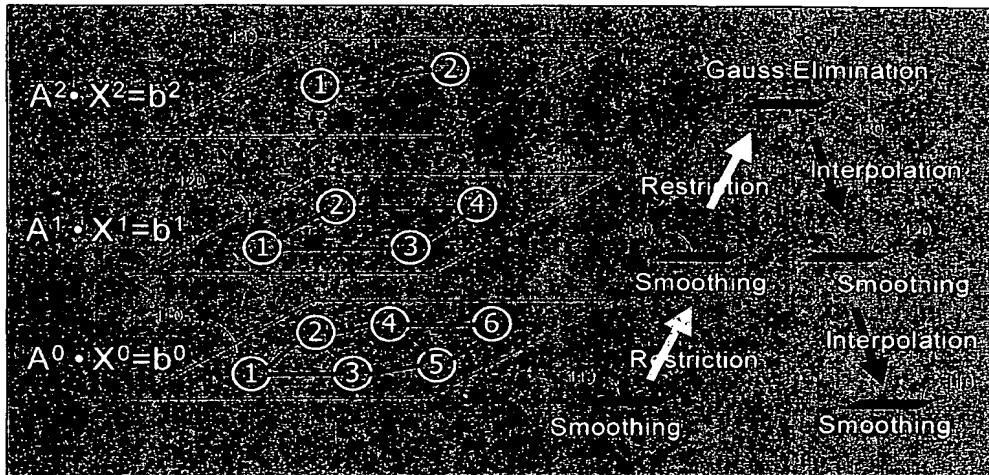
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*[Continued on next page]*

(54) Title: CIRCUIT NETWORK ANALYSIS USING ALGEBRAIC MULTIGRID APPROACH



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(57) Abstract: A technique is provided for applying an algebraic multigrid method to analysis of circuit networks with regular and irregular circuit patterns (Figure 1). Smoothing is performed at each level in the restriction process from the finest level (110) to the coarsest level (130) and in the interpolation process from the coarsest level (130) to the finest level (110). Adaptive processing may be applied to the grid coarsening and error smoothing operations to increase the processing speed.



— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/17237

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G06F 17/50  
US CL : 716/5

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 716/5

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
IEEE, EAST search terms: multigrid, multi, grid, power, coarse, fine, granular, circuit

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Kozhaya, J.N et al. Multigrid-like technique for power grid analysis Computer Aided Design, 2001. ICCAD 2001. IEEE/ACM International Conference on , 4-8 Nov. 2001 Pages 480 - 487	1-11, 14-26
X	Kozhaya, J.N. et al. A multigrid-like technique for power grid analysis Computer-Aided Design of Integrated Circuits and Systems, IEEE Transactions on , Volume: 21 , Issue: 10 , Oct. 2002 Pages:1148 - 1160	1-11, 14-26
A	Nassif, S.R. et al. Multi-grid methods for power grid simulation Circuits and Systems, 2000. Proceedings. ISCAS 2000 Geneva. The 2000 IEEE International Symposium on , Volume: 5 , 28-31 May 2000 Pages:457 - 460 vol.5	1-26

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed		

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## INTERNATIONAL SEARCH REPORT

## C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	La Scala, M. et al. A relaxation type multigrid parallel algorithm for power system transient stability analysis Circuits and Systems, 1989., IEEE International Symposium on , 8-11 May 1989 Pages:1954 - 1957 vol.3	1-26
A	La Scala, M. et al. Relaxation/Newton methods for concurrent time step solution of differential-algebraic equations in power system dynamic simulations Circuits and Systems I: Fundamental Theory and Applications, IEEE Transactions on [see also Circuits and Systems I: Regular Papers, IEEE Transactions on] , Volume: 40 , Issue: 5 , May 1993 Pages:317 - 330	1-26
X	Kai Wang et al. Power/ground mesh area optimization using multigrid-based technique [IC design] Design, Automation and Test in Europe Conference and Exhibition, 2003 , 2003 Pages:850 - 855	1-11, 14-26
X, P	Zhengyong Zhu et al. Power network analysis using an adaptive algebraic multigrid approach Design Automation Conference, 2003. Proceedings , 2-6 June 2003 Pages:105 - 108	1-26